Infinera

INFINERA INSIGHTS

Open Optical Networking

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March 11, 2021

Safe Harbor

Forward-Looking Statements

This presentation contains forward-looking statements, including those related to Infinera's expectations regarding its business model, competition and customers; its expectations regarding market growth, opportunities and trends, including with respect to open optical networking; its expectations regarding benefits of open optical networking to network operators and solution providers; its expectations regarding the timing of its new products being available in the market; its ability to win new customers; its visibility into the performance of its business in future quarters based on the unpredictability of the macro-economic environment and the COVID-19 pandemic; and its financial outlook for 2021. All statements other than statements of historical fact could be deemed forward-looking, including, but not limited to, statements made about future market, financial and operating performance; statements regarding future products or technology, as well as the timing to market of any such products or technology; any statements about historical results that may suggest trends for Infinera's business; and any statements of assumptions underlying any of the items mentioned.

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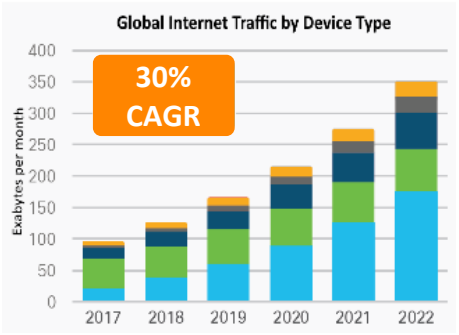
Infinera Insights – Open Optical Networking

1. MARKET DYNAMICS
2. MARKET DRIVERS & SIZING
3. UNDERSTANDING OPEN OPTICAL NETWORKING
4. KEY ELEMENTS FOR SUCCESS

Market Dynamics

BANDWIDTH GROWTH



CONTINUED DEMAND FOR OPTICAL SOLUTIONS

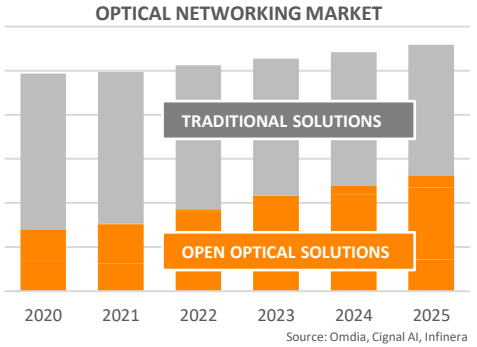
IMPORTANCE OF VERTICAL INTEGRATION

VALIDATING INFINERA CORE STRATEGY

COMPETITIVE DISRUPTION

GEOPOLITICAL EVENTS CREATING OPPORTUNITIES

MOVE TO OPEN



DATA CENTER STYLE NETWORK ARCHITECTURES

GOOD TIME TO BE A VERTICALLY INTEGRATED INNOVATOR IN OPTICAL NETWORKING

Sources: Cisco VNI, Omdia, Cignal AI, Dell'Oro, Infinera

What is Open Networking

Networks that can be **seamlessly built** and **easily operated** leveraging a collection of **modular best-in-class solutions** from any number of solution providers

NETWORK OPERATORS

INCREASED FLEXIBILITY & IMPROVED ECONOMICS

SOLUTION PROVIDERS

INSERTION OPPORTUNITIES & ACCELERATED INNOVATION

Market Transitions to Open

MARKET
INCEPTION

CLOSED

AS A MARKET MATURES,
LOGICAL DISAGGREGATION POINTS BECOME CLEAR

MARKET
MATURITY

OPEN

MARKETS TRANSITIONING TO OPEN IS A COMMON OCCURRENCE

- **CABLE**
- **NETWORK FUNCTION VIRTUALIZATION**
- **ACCESS**
- **ROUTING/ SWITCHING**
- **WIRELESS RAN**

Drivers for Open in Optical Networking

WHAT OPTICAL INNOVATIONS DO SPs WANT?

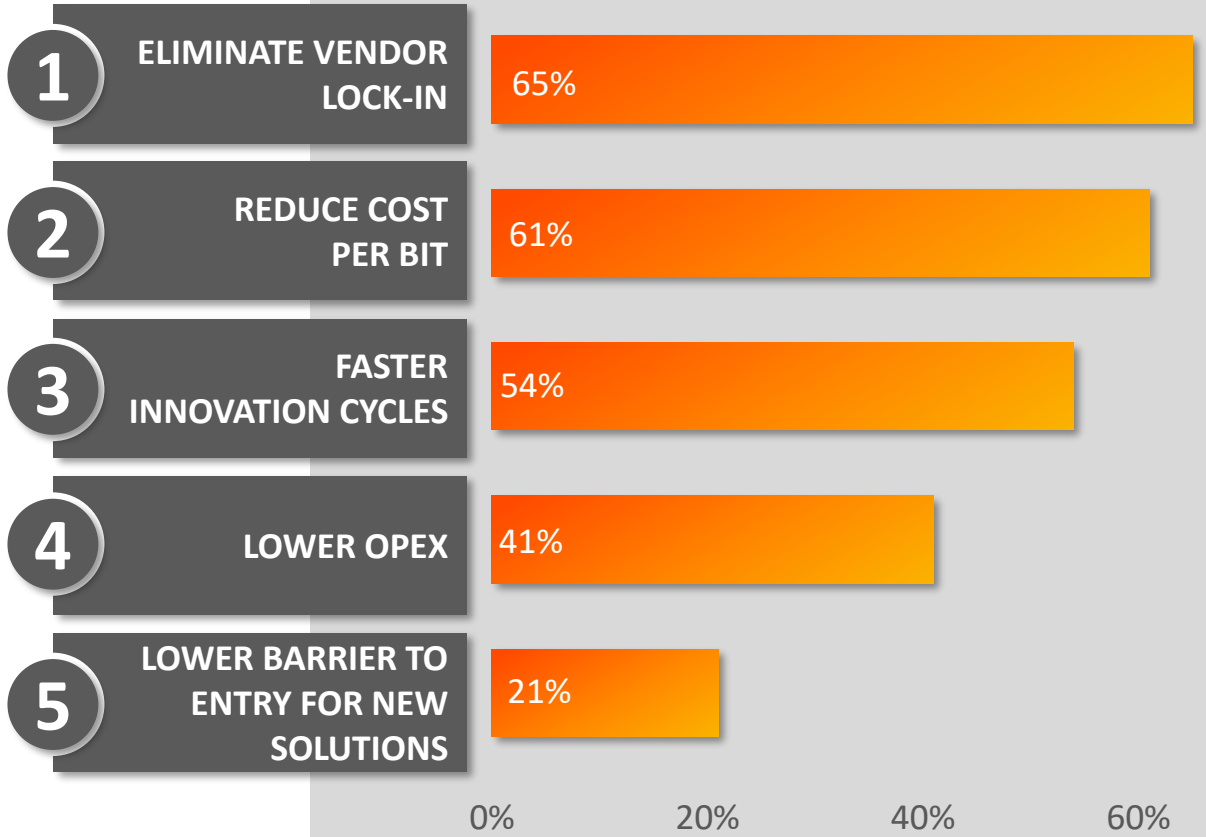
% of respondents rating 7 or above out of 10

1. 68% WAVELENGTH CAPACITY
2. 68% FLEXGRID ROADMS
3. 64% CAPACITY PER FIBER
4. 64% COHERENT PLUGGABLE
5. **57% OPEN OPTICAL**

Source: Omdia Operator Survey

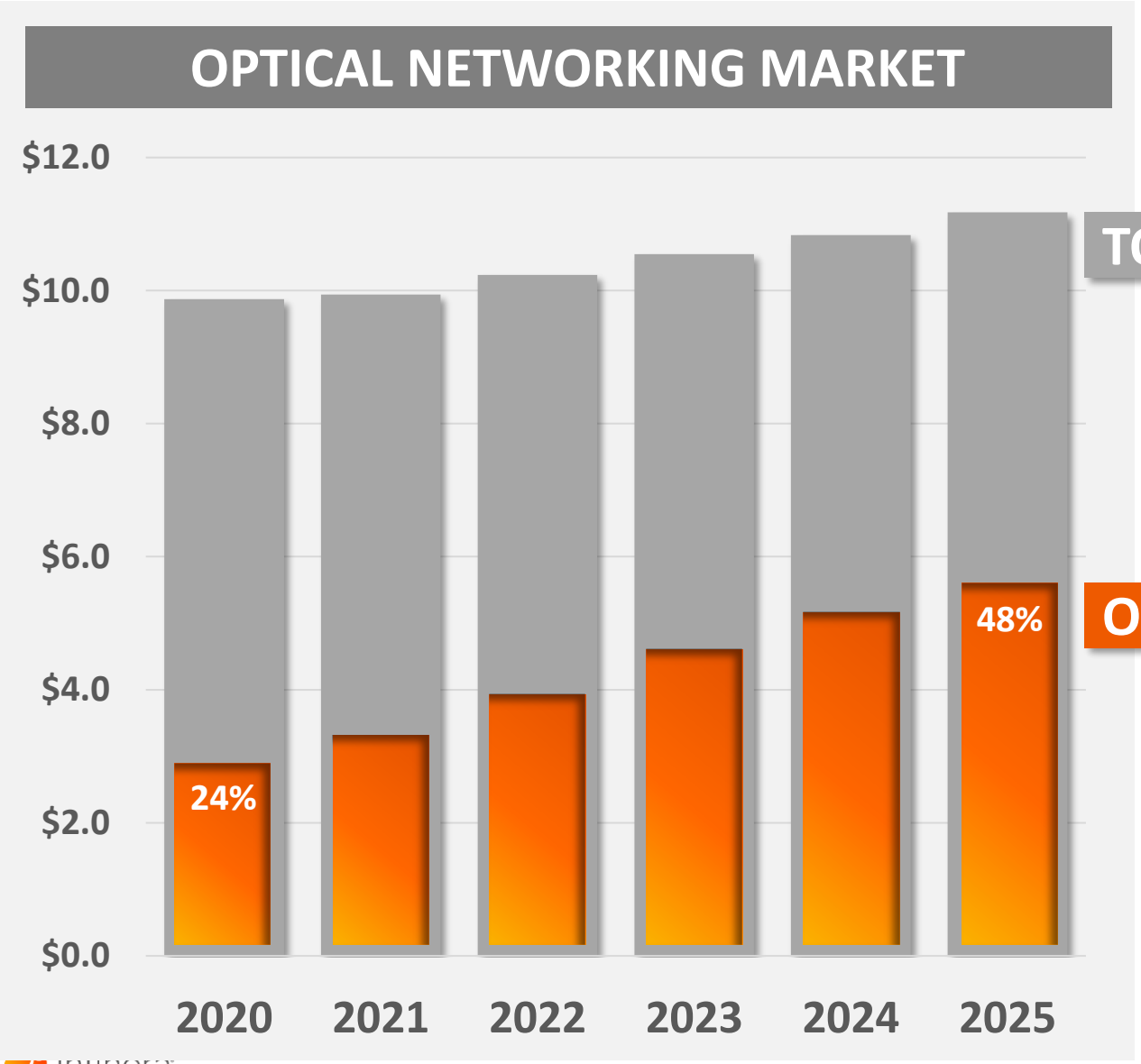
DRIVERS FOR OPEN OPTICAL

WHAT ARE THE BIGGEST BENEFITS OF DEPLOYING A MULTI-VENDOR OPEN OPTICAL NETWORKING SOLUTION?



Source: Heavy Reading Survey

The Rise of Open Optical Networking



TOTAL OPTICAL

$11.2B

2-4% CAGR

OPEN OPTICAL

$5.3B

13-15% CAGR

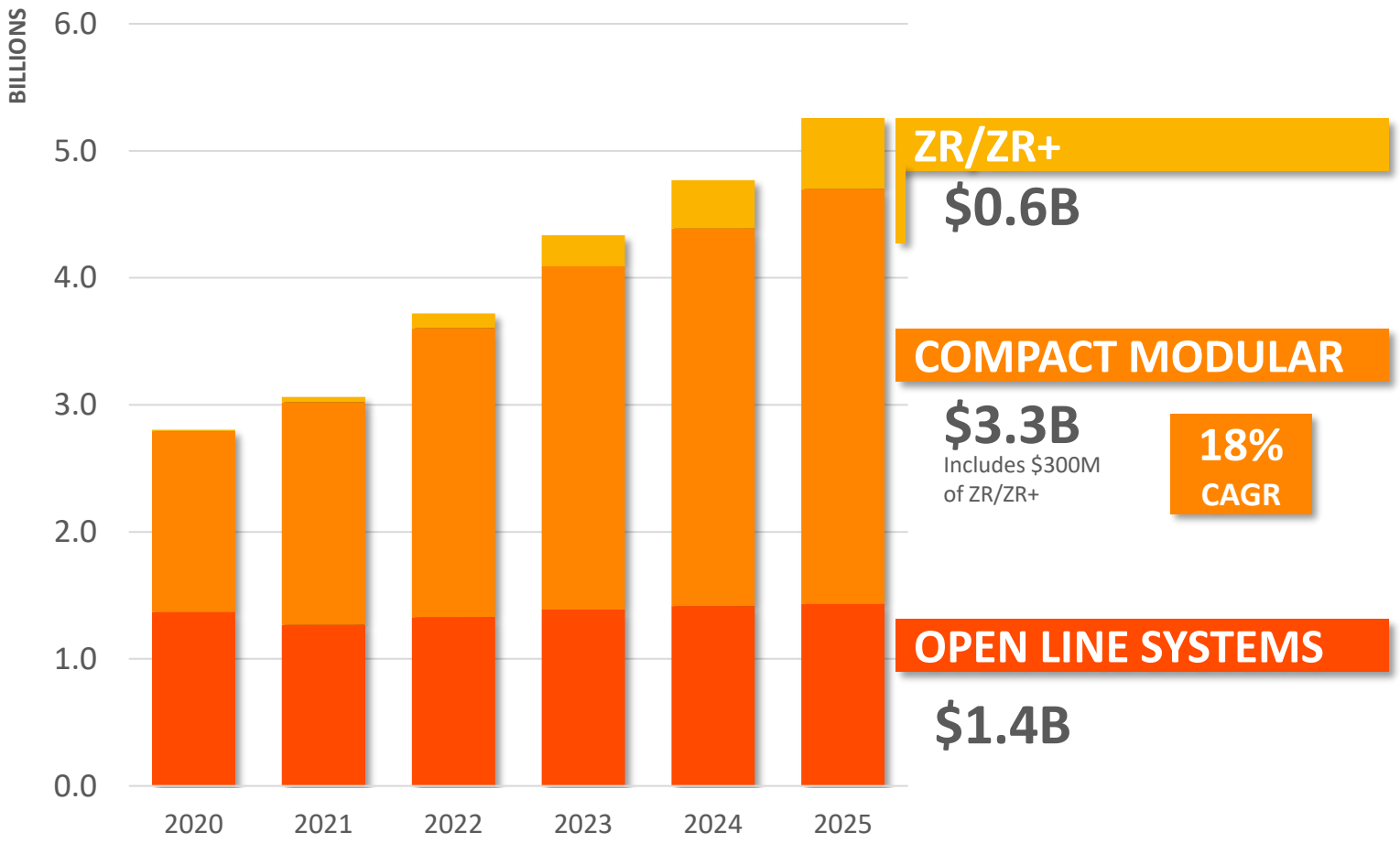
BEYOND ICPs

COMPACT MODULAR SHIPMENTS TO NON-ICP CUSTOMERS

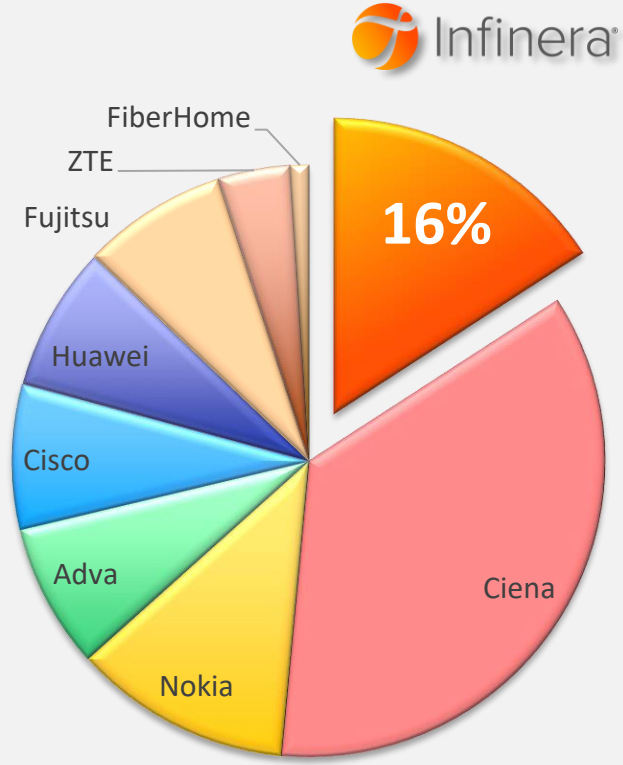
Source: Omdia, LightCounting, Cignal AI, Dell'Oro, Infinera

The Open Optical Networking Market

OPEN OPTICAL MARKET



COMPACT MODULAR MARKET SHARE (FY2020)

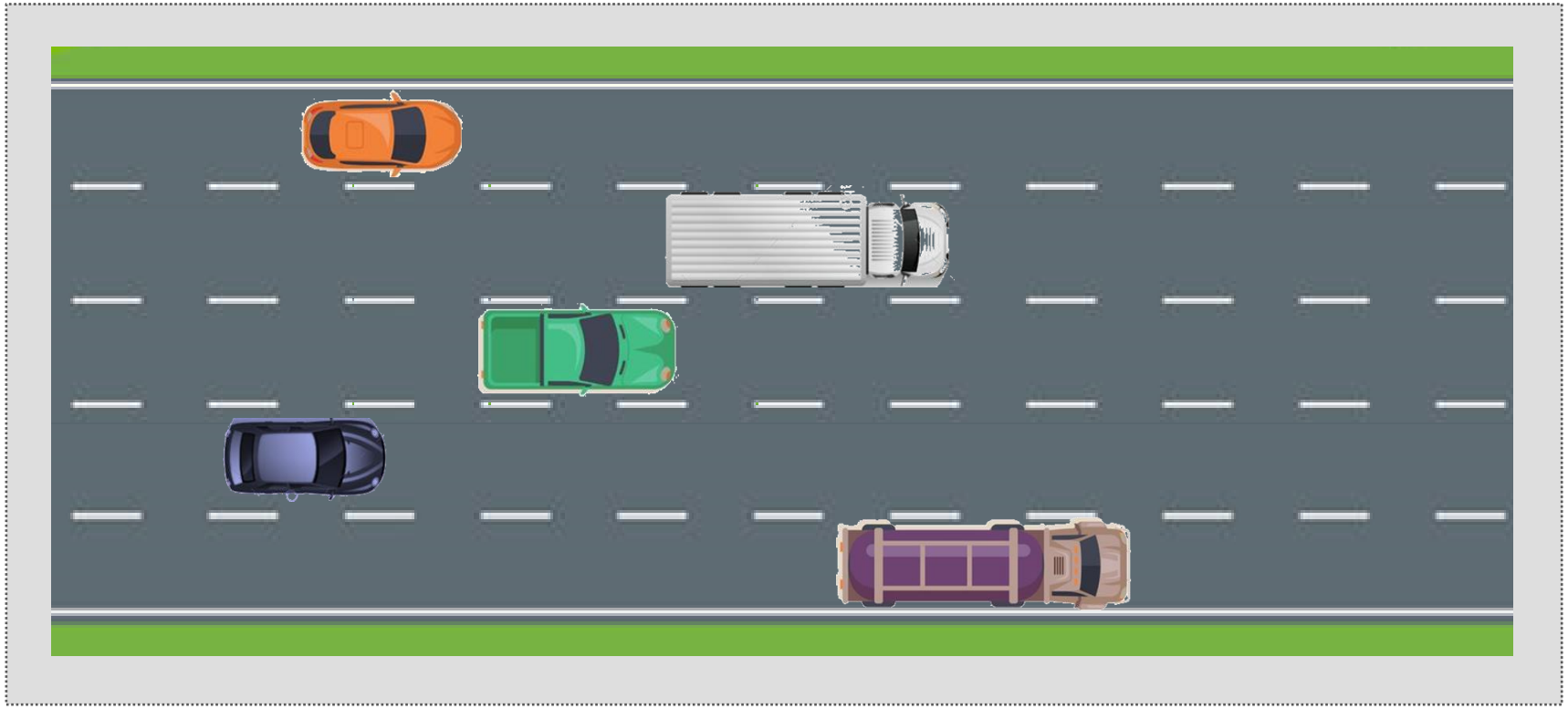


Includes China

Source: Omdia, Cignal AI, Dell'Oro, LightCounting, Infinera

Optical Networks

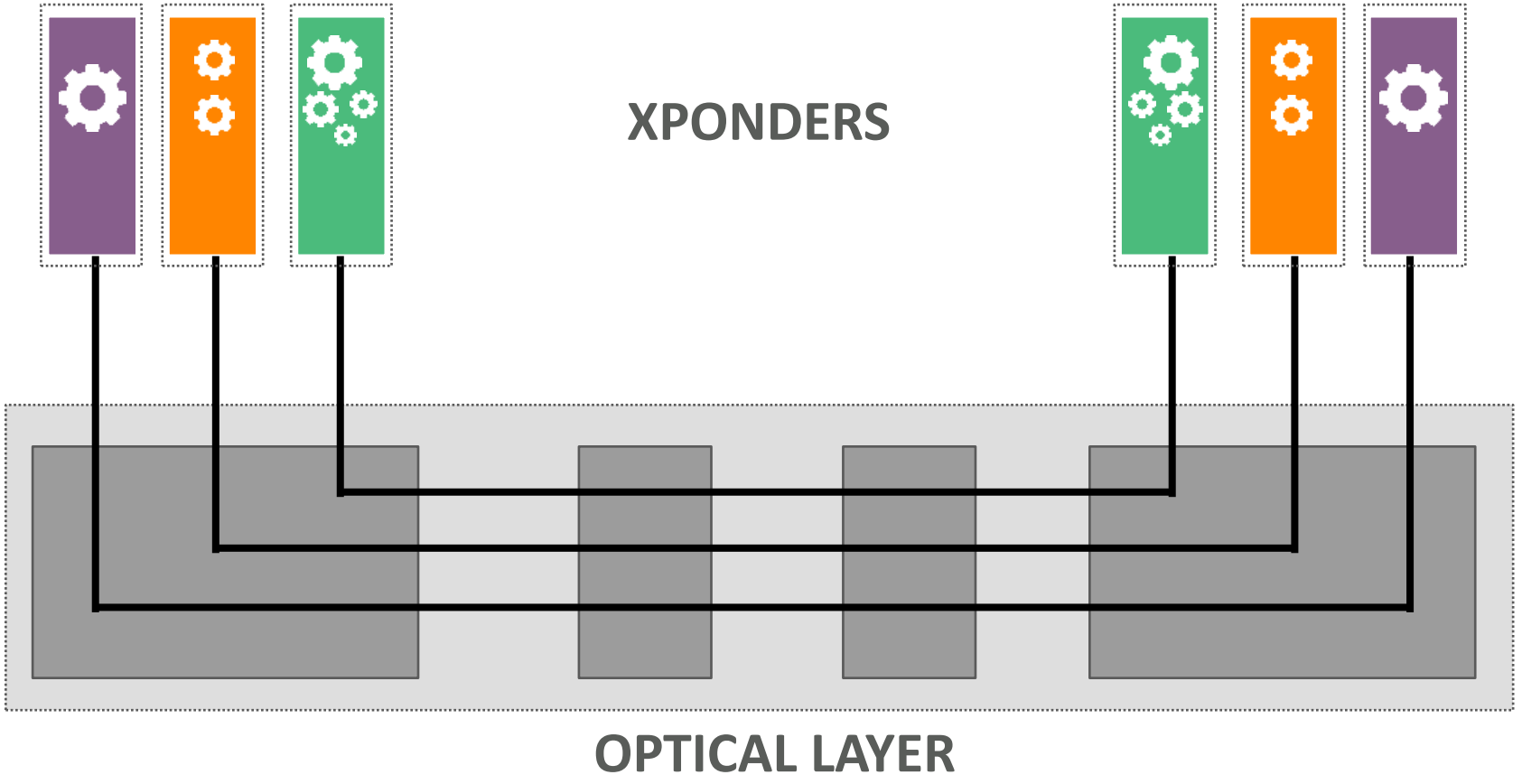
XPONDERS



OPTICAL LAYER

Open Optical Networking

NETWORKS THAT SUPPORT ANY TRANSPONDER OPERATING AT OR NEAR PEAK PERFORMANCE OVER ANY OPTICAL LINE SYSTEM



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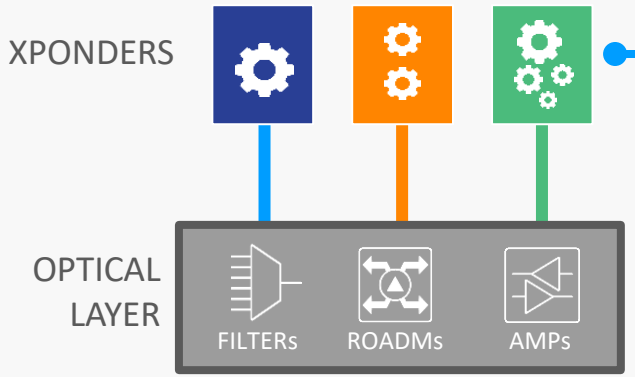
Key Enablers for Open Optical Networking

MAKES OPEN OPTICAL NETWORKS POSSIBLE

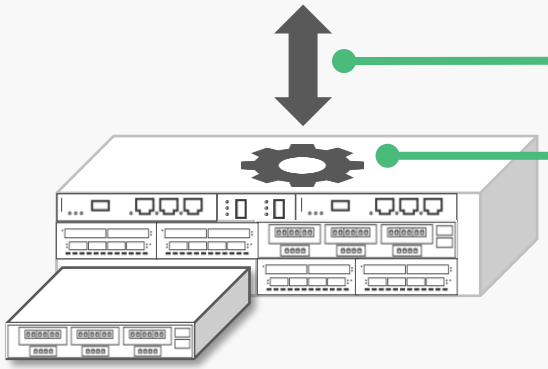
TECHNOLOGY ENABLERS



- ADVANCE DIGITAL SIGNAL PROCESSORS
- INTEGRATED POWER MONITORING & MANAGEMENT

MAKES OPEN OPTICAL NETWORKS EASIER TO DEPLOY

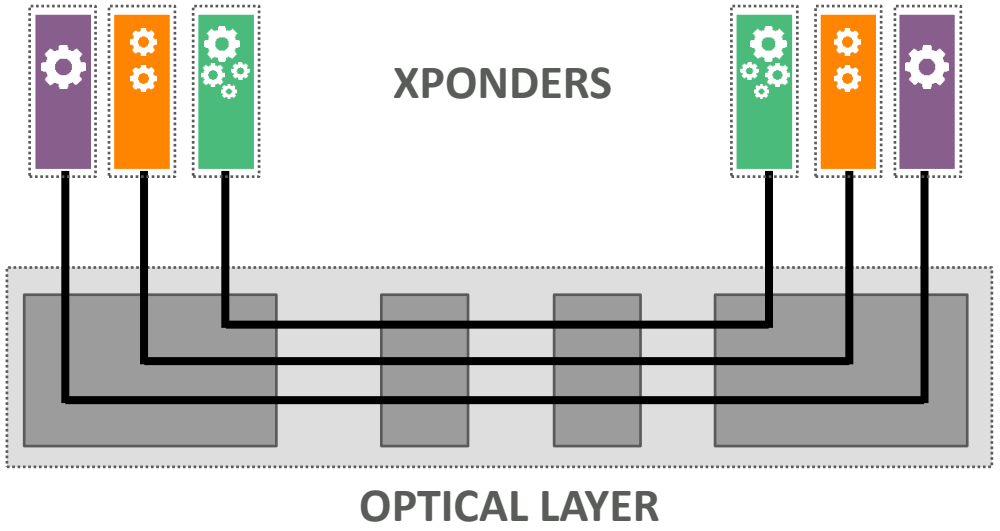
OPERATIONAL ENABLERS



- NETCONF RESTCONF — STANDARDIZED OPEN APIs
- YANG — STANDARDIZED DATA MODELING
- COMPACT MODULAR PLATFORMS

Open Networking for Optical Networks

ANY TRANSPONDER OPERATING AT OR NEAR PEAK PERFORMANCE OVER ANY OPTICAL LINE SYSTEM



BENEFITS

	NETWORK OPERATORS	SOLUTION PROVIDERS
1 ELIMINATE VENDOR LOCK-IN	✓	✓
2 REDUCE COST PER BIT	✓	
3 FASTER INNOVATION CYCLES	✓	✓
4 LOWER OPEX	✓	
5 LOWER BARRIER TO ENTRY FOR NEW SOLUTIONS	✓	✓

Typical Open Optical Networking Question – #1

BENEFITS	NETWORK OPERATORS	SOLUTION PROVIDERS
1 ELIMINATE VENDOR LOCK-IN	✓	✓
2 REDUCE COST PER BIT	✓	
3 FASTER INNOVATION CYCLES	✓	✓
4 LOWER OPEX	✓	
5 LOWER BARRIER TO ENTRY FOR NEW SOLUTIONS	✓	✓

OPEN = INCREASED VALUE OF INNOVATION

No.

"Innovation drives significantly greater network value than commoditization ever will."

Dave Welch
Founder Infinera

EXAMPLE

100G coherent solutions provided significantly greater value than a lower cost 10G solution ever could

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Typical Open Optical Networking Question – #2

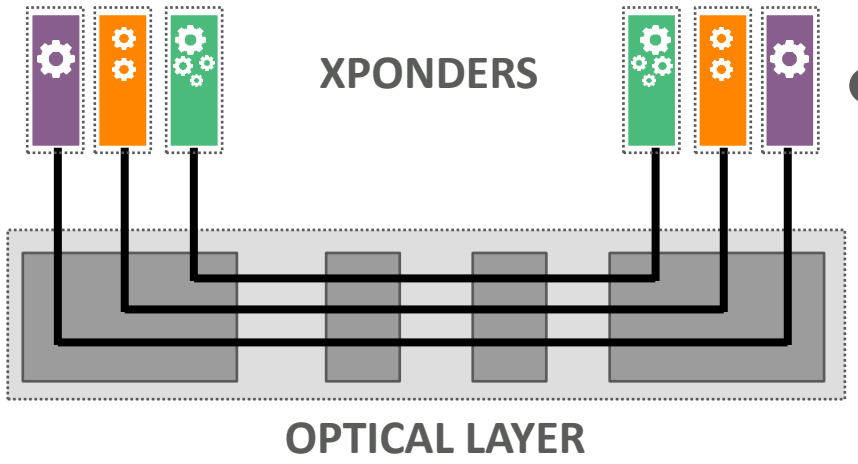
BENEFITS	NETWORK OPERATORS	SOLUTION PROVIDERS
1 ELIMINATE VENDOR LOCK-IN	✓	✓
2 REDUCE COST PER BIT	✓	
3 FASTER INNOVATION CYCLES	✓	✓
4 LOWER OPEX	✓	
5 LOWER BARRIER TO ENTRY FOR NEW SOLUTIONS	✓	✓

OPEN = SHORTER REVENUE CYCLES

No.

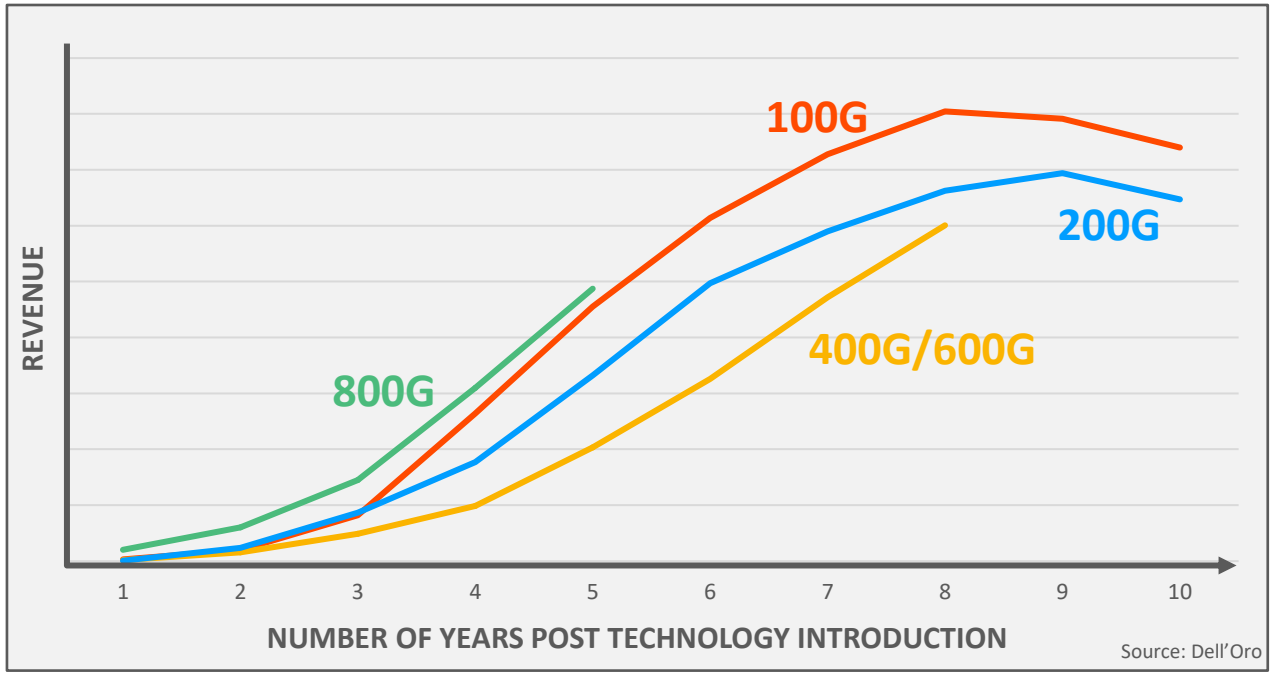
Typical Open Optical Networking Question – #2

3 FASTER INNOVATION CYCLES



OPEN = SHORTER REVENUE CYCLES **No.**

INNOVATION CYCLE	YEARS OF MEANINGFUL REVENUE
2-3 Years	7-10 Years



Acceleration of Open Optical Networking

STANDARDS

OPENCONFIG

ONF

TELECOM INFRA PROJECT

OIF

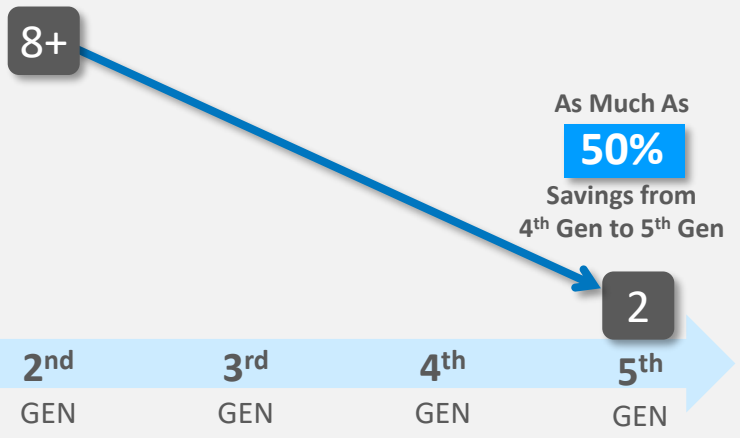
Open ROADM

MEF

IETF

TECHNOLOGY

HIGH SPEED COHERENT SUPPLIERS



~70%

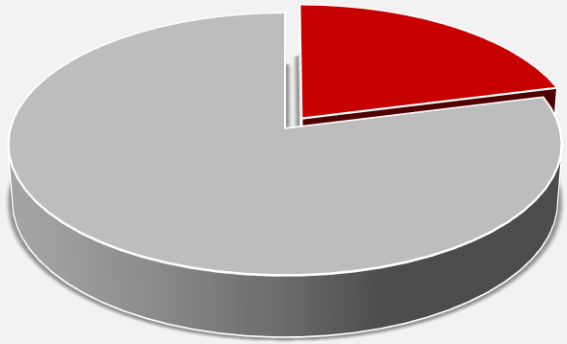
OF NETWORK OPERATORS DO NOT HAVE ACCESS TO 5th GEN TECHNOLOGY WITH CURRENT SUPPLIERS

Source: Omdia, Infinera

SUPPLIER DISRUPTION

HUAWEI

#2 SHARE OF OPTICAL NETWORKING MARKET



21% of Optical Market

excluding China

Source: Omdia

Open Optical Networking Approaches

LARGE ICPs

- Largely independent
- Internally developed software & management

Open ROADM

- AT&T lead initiate
- Very prescriptive & holistic implementation

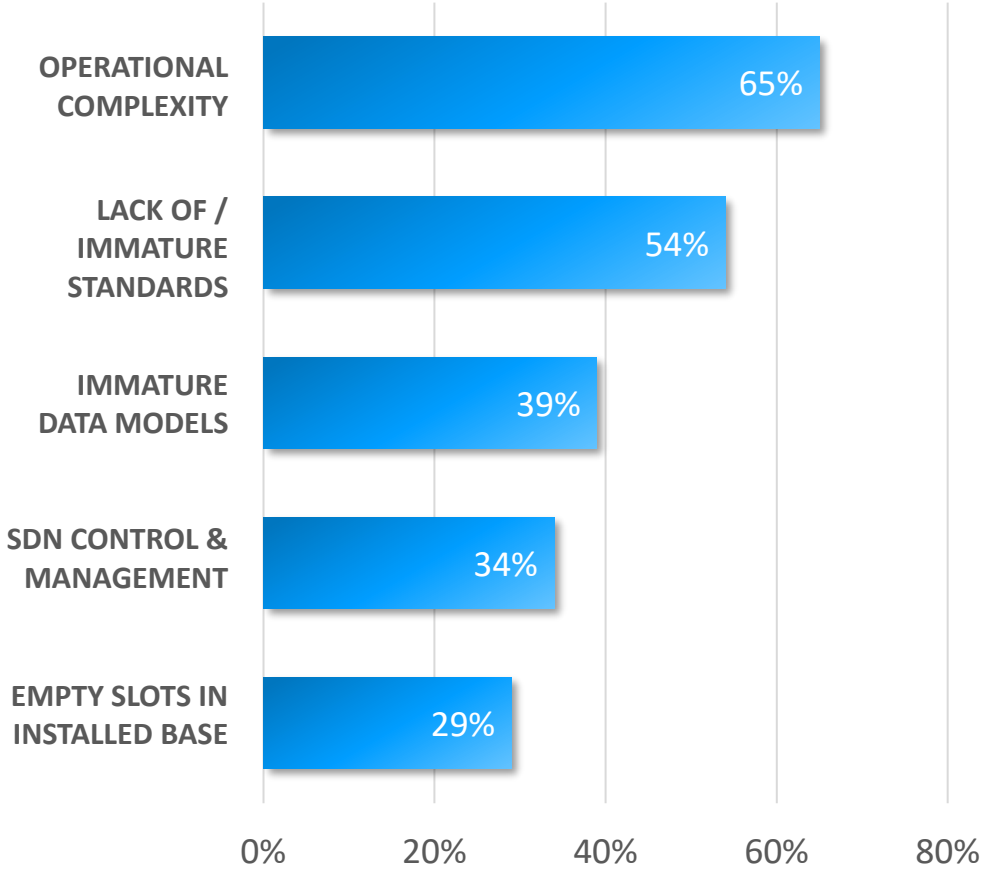
OTHER NETWORK OPERATORS

- Leveraging industry standards developed by industry organizations

Overcoming Barriers

BARRIERS TO OPEN OPTICAL

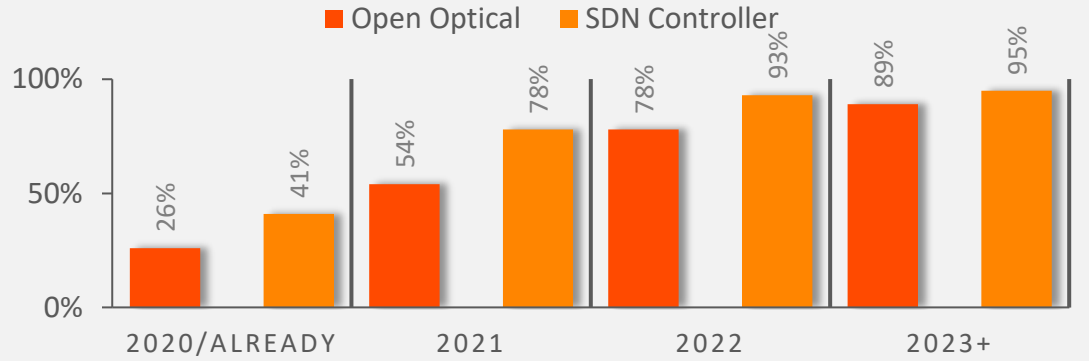
WHAT ARE THE BIGGEST BARRIERS TO THE ADOPTION OF MULTI-VENDOR OPEN OPTICAL NETWORKING? (SELECT ALL THAT APPLY)



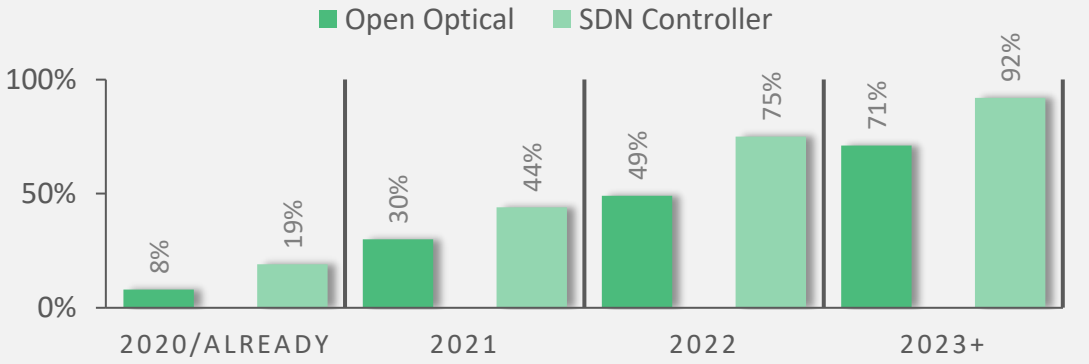
Source: Omdia Network Operator Survey

AUTOMATION AND SDN CAN HELP OVERCOME BARRIERS

NORTH AMERICA



OUTSIDE NORTH AMERICA

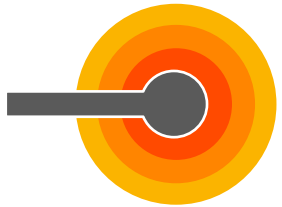


Source: 2020 Heavy Reading Survey

Key Elements to Success in Open Optical

1

OPTICAL ENGINES



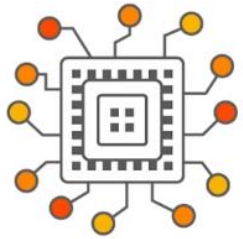
~70% of the cost of a transponder

#1 Driver for lower $/bit & lower power/bit

ANATOMY OF AN OPTICAL ENGINE

OPTICS

+



DIGITAL SIGNAL PROCESSOR (DSP)

+

PACKAGING

CRITICAL FUNCTIONS ENABLING VERTICAL INTEGRATION

ASIC/DSP DESIGN

ANALOG ELECTRONICS DESIGN

HOLISTIC CO-DESIGN

RF INTERCONNECTS

PACKAGING DESIGN

PACKAGING MANUFACTURING

PIC DESIGN

PIC MANUFACTURING

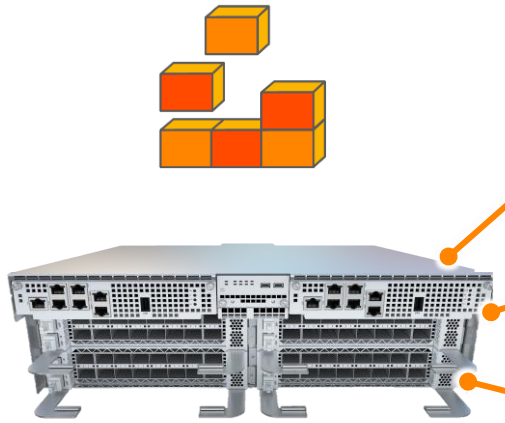
Key Elements to Success in Open Optical

1

OPTICAL ENGINES

2

PLATFORM



COMPACT MODULAR PLATFORMS

>45%

Of transponders deployed in 2025 will be compact modular

Compact Modular platforms are becoming the defacto Open Optical platform standard

Source: Omdia, Cignal AI, Infinera

ANATOMY OF A COMPACT MODULAR

STANDARDIZED DATA MODELING

YANG

NATIVE OPEN INTERFACES

NETCONF
RESTCONF

UNIVERSAL SLED BASED ARCHITECTURE

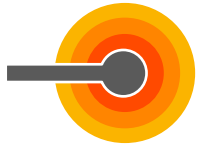
- XPONDERS
- SWITCHING
- OPTICAL LAYER

CARRIER-GRADE FEATURES WILL EXPAND OPPORTUNITIES OUTSIDE ICPs

Key Elements to Success in Open Optical

1

OPTICAL ENGINES



2

PLATFORM

3

SIMPLIFIED OPERATIONS

PLANNING

DEPLOYING

PROVISIONING

TROUBLESHOOTING

TAKE THE "ALIEN" OUT OF ALIEN WAVELENGTH

SOFTWARE

\+

SERVICES

1

Monolithic proprietary vendor-provided orchestrators that replace existing operational ecosystems

2

Discrete modular applications that integrated into existing operational ecosystems

Infinera's Open Optical Networking Portfolio Strategy

1

OPTICAL ENGINES

INFINERA'S OPTICAL INNOVATION CENTER

COMPLETE INNOVATION AND PRODUCTION OF ADVANCED OPTICAL ENGINES

PHOTONIC INTEGRATED CIRCUITS (PICS)	DIGITAL SIGNAL PROCESSOR (DSP)	TECHNOLOGY INTEGRATION
INP FAB, SUNNYVALE, CA	OTTAWA, CANADA	ALLENTOWN, PA

Infinera ICE

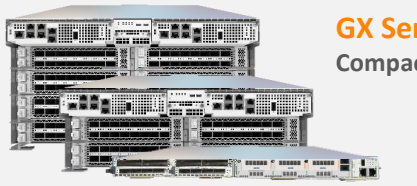
XR OPTICS

2

PLATFORM

HISTORY OF PIONEERING COMPACT MODULAR

- Invented Compact Modular with CloudXpress
- Lead 2nd Gen with Sled Based Architectures
- Leading 3rd Gen with Carrier Grade Features



GX Series

Compact Modular Platform

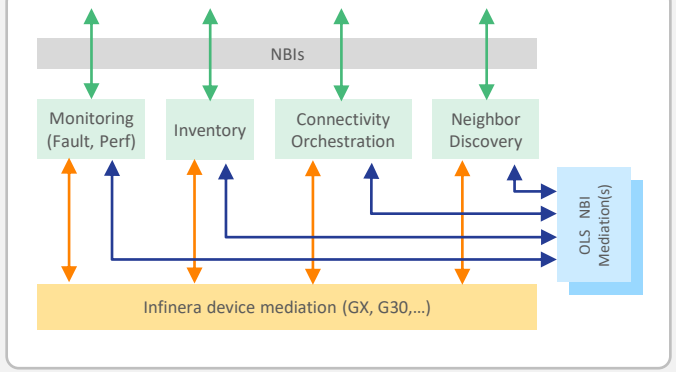
INDUSTRY'S FIRST CARRIER GRADE COMPACT MODULAR PLATFORM

3

SIMPLIFIED OPERATIONS

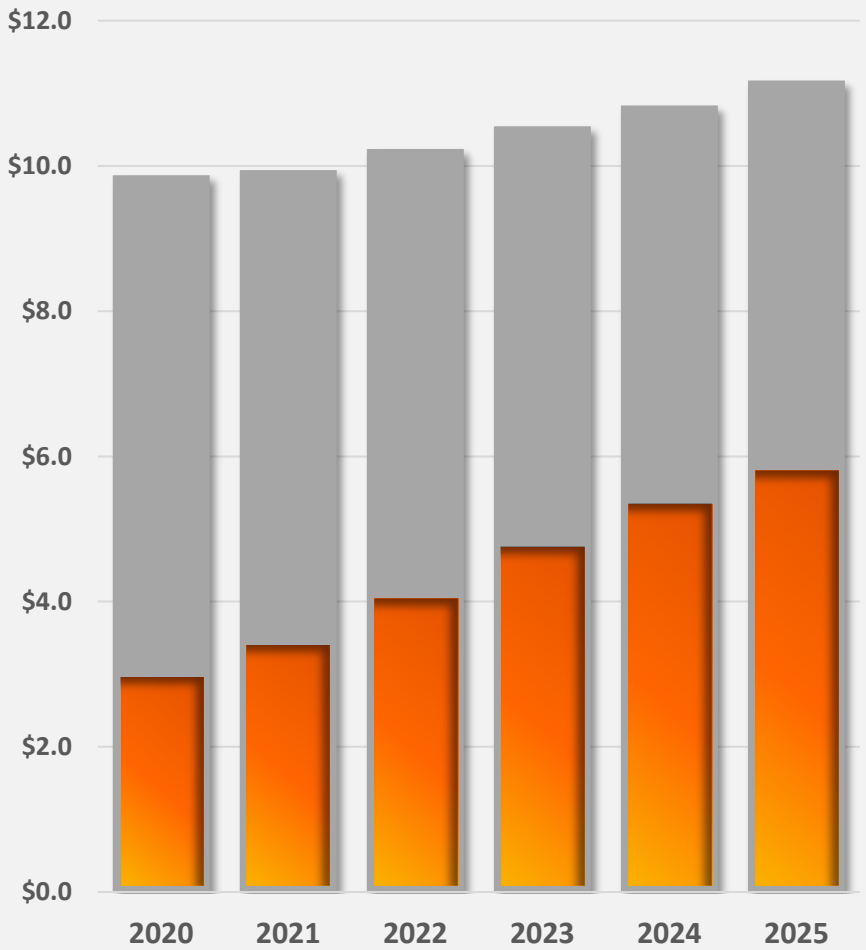
OPEN OPTICAL NETWORKING TOOLKIT

DISCRETE MODULAR SOFTWARE APPs + SERVICES



Summary

OPTICAL NETWORKING MARKET

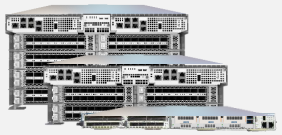


1. OPEN OPTICAL NETWORKING IS A LARGE AND RAPIDLY GROWING MARKET
2. THERE ARE SIGNIFICANT INSERTION OPPORTUNITIES FOR INNOVATORS
3. VERTICAL INTEGRATION IS A KEY COMPONENT FOR SUCCESS

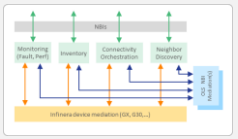
IDEAL MARKET CONDITIONS FOR INFINERA

OPTICAL INNOVATION CENTER

GX SERIES
COMPACT MODULAR PLATFORM



OPEN OPTICAL NETWORKING TOOLKIT



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Q&A
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Thank You

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